

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C. 20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 19 October 2000 (19.10.00)	
International application No. PCT/GB00/00212	Applicant's or agent's file reference C1112.01/C
International filing date (day/month/year) 25 January 2000 (25.01.00)	Priority date (day/month/year) 16 March 1999 (16.03.99)
Applicant RUSHBROOKE, John, Gordon et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

14 August 2000 (14.08.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Pascal Piriou Telephone No.: (41-22) 338.83.38
---	---

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

KEITH W NASH & CO.  
90-92 Regent Street  
Cambridge CB2 1DP  
ROYAUME-UNI

Date of mailing (day/month/year) 09 November 2000 (09.11.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference C1112.01/C	
International application No. PCT/GB00/00212	International filing date (day/month/year) 25 January 2000 (25.01.00)

1. The following indications appeared on record concerning:	
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor <input type="checkbox"/> the agent <input type="checkbox"/> the common representative
Name and Address CAMBRIDGE IMAGING LIMITED St. John's Innovation Centre Cowley Road Cambridge CB4 4WS United Kingdom	State of Nationality GB
	State of Residence GB
	Telephone No.
	Facsimile No.
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:	
<input type="checkbox"/> the person <input type="checkbox"/> the name <input type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence	
Name and Address PACKARD INSTRUMENT COMPANY, INC. 800 Research Parkway Meriden, CT 06450 United States of America	State of Nationality US
	State of Residence US
	Telephone No.
	Facsimile No.
3. Further observations, if necessary:	
4. A copy of this notification has been sent to:	
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer R. Chrem
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

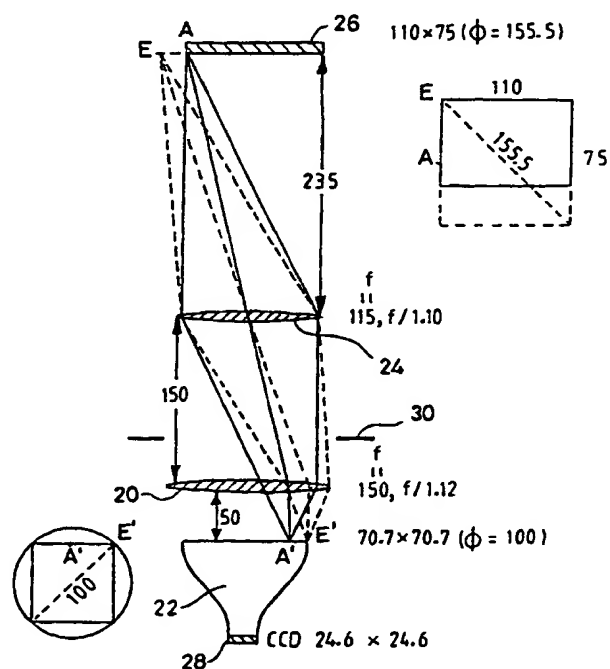
(51) International Patent Classification <sup>7</sup> : <b>G01N 21/25, G02B 6/06</b>	<b>A1</b>	(11) International Publication Number: <b>WO 00/55601</b> (43) International Publication Date: 21 September 2000 (21.09.00)
(21) International Application Number: PCT/GB00/00212 (22) International Filing Date: 25 January 2000 (25.01.00) (30) Priority Data: 9905954.5          16 March 1999 (16.03.99)          GB (71) Applicant (for all designated States except US): CAMBRIDGE IMAGING LIMITED [GB/GB]; St. John's Innovation Centre, Cowley Road, Cambridge CB4 4WS (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): RUSHBROOKE, John, Gordon [GB/GB]; 10 Barrington House, Southacre Park, Southacre Road, Cambridge CB2 2TY (GB). HOOPER, Claire, Elizabeth [GB/GB]; 5 Rotherwick Way, Cambridge CB1 4RX (GB). (74) Agent: KEITH W NASH & CO.; 90-92 Regent Street, Cambridge CB2 1DP (GB).		(81) Designated States: JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  Published With international search report.

(54) Title: SAMPLE IMAGING

## (57) Abstract

An optical system for imaging a multiwell sample plate onto a CCD camera, wherein light from the illuminated sample plate (26) is imaged by one or more lenses (20, 24) onto a fibre optic taper (22), bonded to the input face of the camera (28).

Lens-Taper  
Viewing whole plate (Schematic)



Distance Plate to Taper = 434 mm  
Field of view = 36.6 degrees

*FOR THE PURPOSES OF INFORMATION ONLY*

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00212

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 G01N21/25 G02B6/06

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 07022 A (IMAGING RESEARCH) 19 February 1998 (1998-02-19) abstract page 1, line 35 -page 2, line 3 page 5, line 25 -page 6, line 21 page 11, line 14 - line 22 page 11, line 38 -page 12, line 2 page 21, line 18 -page 22, line 18 page 23, line 17 - line 19	1-3, 7, 15, 18
A	figures 4,5  ---  -/--	9, 16, 17, 20, 21

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "Z" document member of the same patent family

Date of the actual completion of the international search

15 June 2000

Date of mailing of the international search report

21/06/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Thomas, R.M.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00212

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>WO 97 38329 A (XITEC)  16 October 1997 (1997-10-16)  page 3, line 4 - line 6  page 3, line 10 - line 12  page 3, line 18 - line 19  page 4, line 12 - line 15  page 8, line 1 - line 10  page 9, line 13 - line 17  page 12, line 20 -page 13, line 5  page 19, line 10 - line 12</p>	1,7,14, 21
A	<p>figure 1</p> <p>---</p>	11,12
Y	<p>GB 2 315 130 A (CAMBRIDGE IMAGING)  21 January 1998 (1998-01-21)  abstract  page 1, paragraph 2 - paragraph 4  page 13, paragraph 2  page 16, line 14 - line 29  page 17, line 27 -page 18, line 7  page 19, line 10 - line 13  figures 3-5</p> <p>---</p>	1,7,14, 21
A	<p>WO 91 09300 A (IMAGE RESEARCH)  27 June 1991 (1991-06-27)  page 3, line 24 -page 4, line 1  page 7, line 21 - line 27  page 11, last paragraph -page 12, line 20  page 16, last paragraph -page 17, line 7  figure 5</p> <p>-----</p>	1,3,4,7

# INTERNATIONAL SEARCH REPORT

(information on patent family members)

International Application No

PCT/GB 00/00212

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9807022 A	19-02-1998	AU 4241597 A CN 1234114 A	06-03-1998 03-11-1999
WO 9738329 A	16-10-1997	NONE	
GB 2315130 A	21-01-1998	EP 0910790 A EP 0910791 A WO 9801743 A WO 9801744 A GB 2315131 A	28-04-1999 28-04-1999 15-01-1998 15-01-1998 21-01-1998
WO 9109300 A	27-06-1991	AT 144324 T AU 651801 B AU 6879591 A DE 69028925 D DE 69028925 T EP 0504197 A US 5347122 A	15-11-1996 04-08-1994 18-07-1991 21-11-1996 13-02-1997 23-09-1992 13-09-1994

CLAIMS

1. An optical system for imaging a sample plate onto a camera device, wherein the sample plate is imaged onto a CCD camera by the optical combination of at least one lens and a fibre-optic taper.
2. A system according to claim 1, wherein the lens is a multi-component lens.
3. A system according to claim 1 or claim 2, wherein the CCD camera is a bare cooled CCD camera or an intensified CCD camera.
4. A system according to any of claims 1 to 3, wherein a shutter or iris is included in the light path between the sample and the CCD camera.
5. A system according to claim 4, wherein the shutter is located between the lens and the taper input, or between the sample and the lens.
6. A system according to claim 4, wherein the shutter is located between any pair of components of the multi-component lens.
7. A system according to any of claims 1 to 6, wherein the entire sample plate is imaged and analysed in a single exposure.
8. A system according to any of claims 1 to 6, wherein part of the sample plate is imaged at a time, so that the whole plate can be imaged and analysed by means of multiple exposures.



9. A system according to any of claims 1 to 8, having an imaging lens located close to the sample and a field lens located close to the taper input.

10. A system according to claim 9, wherein the field lens acts to bend the light rays so as to be normal to the taper, hence minimising any loss of light due to rays entering the taper at angles outside the maximum acceptable angle  $\theta = \sin^{-1}(NA)$ , where NA is the numerical aperture of the taper, (equal to the magnification).

11. A system according to claim 9 or claim 10, wherein efficient light gathering is achieved by bringing the sample plate as close as possible to the imaging lens and arranging the lens powers to cause the cone of light entering the fibre optic taper at least substantially to fill the numerical aperture (NA) of the taper.

12. A system according to any of claims 9 to 11, wherein the light gathering efficiency is of the order of 3.5%.

13. A system according to any of claims 1 to 12, wherein the taper gives a demagnification of the order of 2.87.

14. A system according to any of claims 1 to 13, wherein the imaging lens has a numerical aperture sufficiently large to fill the numerical aperture of the taper.

15. A system according to any of claims 1 to 12, wherein the imaging lens is a complex lens consisting of a number of separate lens components.

16. A system according to claim 5, wherein the complex lens is designed to be telecentric at either input or output or both.

17. A system according to claim 9 or any claim appendant thereon, wherein a second field lens is mounted close to the sample plate to select rays generally normal to the plate, even near to the edge of the plate, and thereby minimise parallax effects.

18. A system according to claim 7 or any claim appendant thereto, wherein the imaging lens and the field lens or lenses are combined with a single, multi-component optical system possessing the property of telecentricity at the object and image.

19. A system according to any of claims 1 to 12, using a laser light source to illuminate the sample.

20. A system according to claim 17, wherein both field lenses are multi-element lenses.

21. A system for imaging a whole sample plate, or part thereof comprising at least one multi-component lens and a fibre optic taper, wherein the power of the lens receiving light from the sample plate is arranged to cause the cone of light entering the taper to fall within the numerical aperture of a taper, the output face of which is bonded to a CCD camera.

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>C1112.01/C</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 00212</b>	International filing date (day/month/year) <b>25/01/2000</b>	(Earliest) Priority Date (day/month/year) <b>16/03/1999</b>
Applicant  <b>CAMBRIDGE IMAGING LIMITED et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

### 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2  
☐ None of the figures.

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G01N21/25 G02B6/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 07022 A (IMAGING RESEARCH) 19 February 1998 (1998-02-19) abstract page 1, line 35 -page 2, line 3 page 5, line 25 -page 6, line 21 page 11, line 14 - line 22 page 11, line 38 -page 12, line 2 page 21, line 18 -page 22, line 18 page 23, line 17 - line 19 figures 4,5	1-3,7, 15,18
A	--- -/--	9,16,17, 20,21

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

15 June 2000

Date of mailing of the international search report

21/06/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Thomas, R.M.

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 97 38329 A (XITEC) 16 October 1997 (1997-10-16) page 3, line 4 - line 6 page 3, line 10 - line 12 page 3, line 18 - line 19 page 4, line 12 - line 15 page 8, line 1 - line 10 page 9, line 13 - line 17 page 12, line 20 -page 13, line 5 page 19, line 10 - line 12	1,7,14, 21
A	figure 1 ---	11,12
Y	GB 2 315 130 A (CAMBRIDGE IMAGING) 21 January 1998 (1998-01-21) abstract page 1, paragraph 2 - paragraph 4 page 13, paragraph 2 page 16, line 14 - line 29 page 17, line 27 -page 18, line 7 page 19, line 10 - line 13 figures 3-5 ---	1,7,14, 21
A	WO 91 09300 A (IMAGE RESEARCH) 27 June 1991 (1991-06-27) page 3, line 24 -page 4, line 1 page 7, line 21 - line 27 page 11, last paragraph -page 12, line 20 page 16, last paragraph -page 17, line 7 figure 5 -----	1,3,4,7

# INTERNATIONAL SEARCH REPORT

Information on patent family members

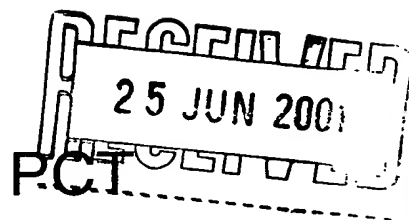
International Application No

PCT/GB 00/00212

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9807022 A	19-02-1998	AU 4241597 A CN 1234114 A	06-03-1998 03-11-1999
WO 9738329 A	16-10-1997	NONE	
GB 2315130 A	21-01-1998	EP 0910790 A EP 0910791 A WO 9801743 A WO 9801744 A GB 2315131 A	28-04-1999 28-04-1999 15-01-1998 15-01-1998 21-01-1998
WO 9109300 A	27-06-1991	AT 144324 T AU 651801 B AU 6879591 A DE 69028925 D DE 69028925 T EP 0504197 A US 5347122 A	15-11-1996 04-08-1994 18-07-1991 21-11-1996 13-02-1997 23-09-1992 13-09-1994

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY



To:

Keith W Nash & Co  
90-92 Regent Street  
Cambridge CB2 1DP  
GRANDE BRETAGNE

## NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Rule 71.1)

Date of mailing  
(day/month/year) 19.06.2001

Applicant's or agent's file reference  
C1112.01/C

### IMPORTANT NOTIFICATION

International application No.  
PCT/GB00/00212

International filing date (day/month/year)  
25/01/2000

Priority date (day/month/year)  
16/03/1999

Applicant  
CAMBRIDGE IMAGING LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

#### 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
Fax: +49 89 2399 - 4465

Authorized officer

Weber, R

Tel. +49 89 2399-2382





# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>C1112.01/C</b>		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/GB00/00212</b>	International filing date ( <i>day/month/year</i> ) <b>25/01/2000</b>	Priority date ( <i>day/month/year</i> ) <b>16/03/1999</b>	
International Patent Classification (IPC) or national classification and IPC <b>G01N21/25</b>			
Applicant <b>CAMBRIDGE IMAGING LIMITED et al.</b>			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 3 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>			
Date of submission of the demand <b>14/08/2000</b>		Date of completion of this report <b>19.06.2001</b>	
Name and mailing address of the international preliminary examining authority:  <b>European Patent Office</b> <b>D-80298 Munich</b> <b>Tel. +49 89 2399 - 0 Tx: 523656 epmu d</b> <b>Fax: +49 89 2399 - 4465</b>		Authorized officer  <b>Rouault, P</b>  Telephone No. +49 89 2399 2776 	



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/00212

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-7 as originally filed

**Claims, No.:**

1-19 as received on 13/03/2001 with letter of 01/03/2001

**Drawings, sheets:**

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/00212

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-19
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-19
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

---

International application No. PCT/GB00/00212

Concerning item V:

1. Reference is made to the following documents:

D1=WO-A-9807022

D2=GB-A-2315130

D3=WO-A-9738239

2. The closest prior art is represented by document D1 which discloses an optical system such as described in the preamble of new Claim 1 of the application.
3. The optical system according to new Claim 1 differs from the optical system known from D1 in that the lens is designed to be telecentric at least at its output, i.e. the extremity of the lens disposed in front of the fibre-optic taper defined in Claim 1. This feature minimises any loss of light due to rays entering the taper at angles outside the maximum acceptable angle ( $\theta = \sin^{-1} NA$ , where NA is the numerical aperture of the taper).
4. This solution is not suggested by the available prior art.

Document D1 reveals a lens which is telecentric only at the extremity facing the object to be imaged. This allows the obtention of a parallax free image. However, D1 is silent on the advantages which could arise from the use of a telecentric lens at the other extremity.

Documents D2 and D3 are not concerned with the use of a combination of a telecentric lens and a fibre-optic taper.



5. Therefore, the subject-matter of present Claim 1, as well as that of independent Claim 19, which contains all the features of Claim 1, and of dependent Claims 2 to 18, is considered to be new and inventive with respect to the available prior art. Accordingly, the present application meets the requirements of Art. 33 (2) and (3) PCT.

## PCT

REC'D 21 JUL 2001

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference C1112.01/C		FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/00212	International filing date (day/month/year) 25/01/2000	Priority date (day/month/year) 16/03/1999	
International Patent Classification (IPC) or national classification and IPC G01N21/25			
Applicant CAMBRIDGE IMAGING LIMITED et al. 7 PACKARD INSTRUMENT COMPANY, INC.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 3 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"><li>I <input checked="" type="checkbox"/> Basis of the report</li><li>II <input type="checkbox"/> Priority</li><li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li><li>IV <input type="checkbox"/> Lack of unity of invention</li><li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li><li>VI <input type="checkbox"/> Certain documents cited</li><li>VII <input type="checkbox"/> Certain defects in the international application</li><li>VIII <input type="checkbox"/> Certain observations on the international application</li></ul>			
Date of submission of the demand 14/08/2000		Date of completion of this report 19.06.2001	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer Rouault, P Telephone No. +49 89 2399 2776 	

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/00212

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-7 as originally filed

**Claims, No.:**

1-19 as received on 13/03/2001 with letter of 01/03/2001

**Drawings, sheets:**

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/00212

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-19
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-19
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

Concerning item V:

1. Reference is made to the following documents:

D1=WO-A-9807022

D2=GB-A-2315130

D3=WO-A-9738239

2. The closest prior art is represented by document D1 which discloses an optical system such as described in the preamble of new Claim 1 of the application.
3. The optical system according to new Claim 1 differs from the optical system known from D1 in that the lens is designed to be telecentric at least at its output, i.e. the extremity of the lens disposed in front of the fibre-optic taper defined in Claim 1. This feature minimises any loss of light due to rays entering the taper at angles outside the maximum acceptable angle ( $\theta = \sin^{-1} NA$ , where NA is the numerical aperture of the taper).
4. This solution is not suggested by the available prior art.

Document D1 reveals a lens which is telecentric only at the extremity facing the object to be imaged. This allows the obtention of a parallax free image. However, D1 is silent on the advantages which could arise from the use of a telecentric lens at the other extremity.

Documents D2 and D3 are not concerned with the use of a combination of a telecentric lens and a fibre-optic taper.

5. Therefore, the subject-matter of present Claim 1, as well as that of independent Claim 19, which contains all the features of Claim 1, and of dependent Claims 2 to 18, is considered to be new and inventive with respect to the available prior art. Accordingly, the present application meets the requirements of Art. 33 (2) and (3) PCT.

C1112.01/C

CLAIMS

1. An optical system for imaging a sample plate onto a camera device, wherein the sample plate is imaged into a CCD camera by the optical combination of at least one lens through which light enters a fibre-optic taper, characterised in that the lens is a complex lens designed to be telecentric at least at its output, whereby light enters the taper at any point of its input face on average normal thereto.
2. A system according to claim 1, wherein the lens is a multi-component lens.
3. A system according to claim 1 or claim 2, wherein the CCD camera is a bare cooled CCD camera or an intensified CCD camera.
4. A system according to any of claims 1 to 3, wherein a shutter or iris is included in the light path between the sample and the CCD camera.
5. A system according to claim 4, wherein the shutter is located between the lens and the taper input, or between the sample and the lens.
6. A system according to claim 4 when appendant to claim 2, wherein the shutter is located between any pair of components of the multi-component lens.
7. A system according to any of claims 1 to 6, wherein the entire sample plate is imaged and analysed in a single exposure.
8. A system according to any of claims 1 to 6, wherein part of the sample plate is imaged at a time, so that the whole plate can be imaged and analysed by means of multiple exposures.



9. A system according to any of claims 1 to 8, wherein the complex lens comprises an imaging lens located close to the sample and a field lens located close to the taper input.
10. A system according to claim 9, wherein the field lens acts to bend the light rays so as to be on average normal to the taper, hence minimising any loss of light due to rays entering the taper at angles outside the maximum acceptable angle  $\theta = \sin^{-1}(NA)$ , where NA is the numerical aperture of the taper, (equal to the magnification).
11. A system according to claim 9 or claim 10, wherein efficient light gathering is achieved by bringing the sample plate as close as possible to the imaging lens and arranging the lens powers to cause the cone of light entering the fibre optic taper at least substantially to fill the numerical aperture (NA) of the taper.
12. A system according to any of claims 9 to 11, wherein the light gathering efficiency is of the order of 3.5%.
13. A system according to any of claims 1 to 12, wherein the taper gives a demagnification of the order of 2.87.
14. A system according to any of claims 9 to 13, wherein the imaging lens has a numerical aperture sufficiently large to fill the numerical aperture of the taper.
15. A system according to any of claims 1 to 14, wherein the complex lens is designed also to be telecentric at its input.
16. A system according to claim 9 or any claim appendant thereon, wherein the complex lens also includes a second field lens mounted close to the sample plate to select rays generally normal to the plate, even near to the edge of the plate, and thereby minimise parallax effects.

17. A system according to any of claims 1 to 12, using a laser light source to illuminate the sample.
18. A system according to claim 16, wherein both field lenses are multi-element lenses.
19. A system for imaging a whole sample plate, or part thereof, comprising at least one complex lens through which light enters a fibre optic taper, wherein the lens is telecentric at least at its output and the power of the lens receiving light from the sample plate is arranged to cause the cone of light entering the taper to fall within the numerical aperture of a taper, the output face of which is bonded to a CCD camera.